

Patent Claims

1. A magnetoresistive read/write memory, with a plurality of multivalued storage cells (11), each storage cell (11) having two intersecting electric conductors (12, 13) and a layer system comprising magnetic layers located at the intersection of the electric conductors (12, 13), wherein the layer system is designed as a multilayer system (30; 40) with two or more magnetic layers (31, 32; 41-45), at least two, but a maximum of all the magnetic layers (31, 32; 41-45) have a magnetization direction (33, 34; 46-50) that can be set independently of one another, the magnetization direction (33, 34; 46-50) in the individual layers (31, 32; 41-45) is changed or can be changed by the electric current flowing through the electric conductors (12, 13), in each case a tunnel dielectric (33; 51) is provided between two adjacent magnetic layers (31, 32; 41-46).
2. The magnetoresistive read/write memory as claimed in claim 1, in which the magnetization directions (33, 34; 46-50) that can be set independently of one another in the individual layers (31, 32; 41-45) are set or can be set via different current intensities.
3. The magnetoresistive read/write memory as claimed in claim 1 or 2, in which the electric conductors (12, 13) are designed for high current densities.
4. The magnetoresistive read/write memory as claimed in one of claims 1 to 3, in which the magnetic layers (31, 32; 41-45) are formed from a ferromagnetic material.
5. The magnetoresistive read/write memory as claimed in one of claims 1 to 4, in which the intersecting

conductors (12, 13) are aligned orthogonally to one another.

6. The magnetoresistive read/write memory as claimed
5 in one of claims 1 to 5, in which the tunnel dielectric has a thickness of 2 to 3 nm.

7. A method of writing to a magnetoresistive
read/write memory as claimed in one of claims 1 to 6,
10 having the following steps:
a) impressing a variable electric current into the two
electric conductors and, as a result, producing a
magnetic field;
b) setting the magnetization direction in the
15 individual magnetic layers of the multilayer system via
the field strength of the magnetic field produced, the
magnetization directions in the individual layers being
set independently of one another via respectively
differently high requisite field strengths, in such a
20 way that the magnetization directions are set first in
those layers which need the highest field strength for
this purpose and that the magnetization directions are
then set in those layers which respectively need a
lower field strength for this purpose.

25 8. The method as claimed in claim 7, in which the
different field strengths acting on the layers are
produced by currents of different magnitudes being
impressed into the conductors.

30 9. The method as claimed in claim 7 or 8, in which
the different field strengths acting on the layers are
produced by means of a different physical spacing of
the layers in relation to the conductors

35 10. The method as claimed in one of claims 7 to 9, in
which the setting of the magnetization directions in
the layers on the basis of field strengths of different

magnitudes are influenced by the layer material and/or the layer thickness and/or the layer morphology.

11. A method of reading from a magnetoresistive read/write memory as claimed in one of claims 1 to 6, having the following steps:

- a) impressing a defined item of data into the individual layers of the multilayer system in such a way that the item of data is first impressed into that layer which needs the lowest field strength to set the magnetization direction, and that the item of data is then impressed into the layers having the respectively next higher requisite field strength; and
- b) detecting a possible information change in the layer or the layers on the basis of the impressed defined item of data.

12. The method as claimed in claim 11, in which the detection of a possible information change in the layer or the layers is carried out by measuring the electrical resistance.

13. The method as claimed in claim 11 or 12, in which the detection of a possible information change in the layer or the layers is carried out via detection of current and/or voltage pulses.

14. The method as claimed in one of claims 11 to 13, in which the detection of a possible information change in the layer or the layers is carried out before and after the impression and/or during the impression of the specific item of data into the layer or the layers.

15. The method as claimed in one of claims 11 to 14, in which an item of data with respectively the same value is successively impressed into all the layers.

16. The method as claimed in one of claims 11 to 14, in which an item of data which belongs to an alternating algorithm is impressed successively into the layers.

5

17. The method as claimed in one of claims 11 to 16, in which the results during the detection of a possible information change for each layer are intermediately stored, at least temporarily, in a storage device.